

United States  
Environmental Protection Agency  
Region 10  
1200 Sixth Avenue  
Seattle, Washington 98101

**Total Maximum Daily Load (TMDL)  
For  
Poly-Chlorinated Biphenyl (PCBs)  
In Garrison Slough, Alaska**

In compliance with the provisions of the Clean Water Act, 33 U.S.C. § 1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4, the Environmental Protection Agency is hereby establishing a Total Maximum Daily Load (TMDL) that would remove contaminated sediments from Garrison Slough thereby restoring the beneficial use of this water body.

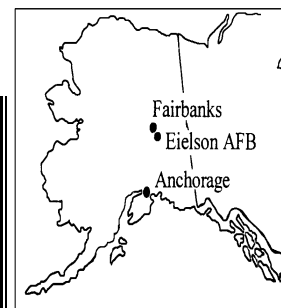
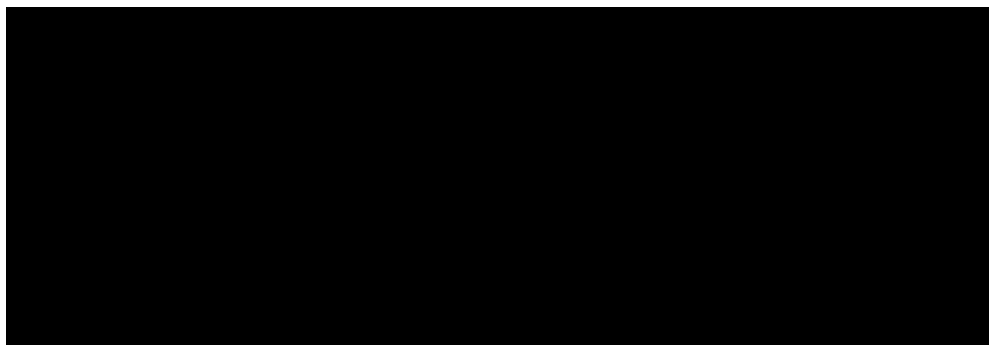
This TMDL shall become effective immediately, and is incorporated into the water quality management plan for the State of Alaska under Clean Water Act § 303(e). Subsequent actions must be consistent with this TMDL.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 1996.

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Phillip G. Milliam  
Office of Water, Director

# Garrison Slough



## TMDL AT A GLANCE:

Water Quality Limited?: Yes

Segment Identifier: 40506-009

Parameter of Concern: Polychlorinated Biphenyls (PCBs)

Uses Affected: Water Contact Recreation

Growth and Propagation of Fish, Shellfish

Source: Eielson AFB

Type of TMDL: Non-Point Source

Load Reduction: 80% Reduction of Contaminated Sediments

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## OVERVIEW:

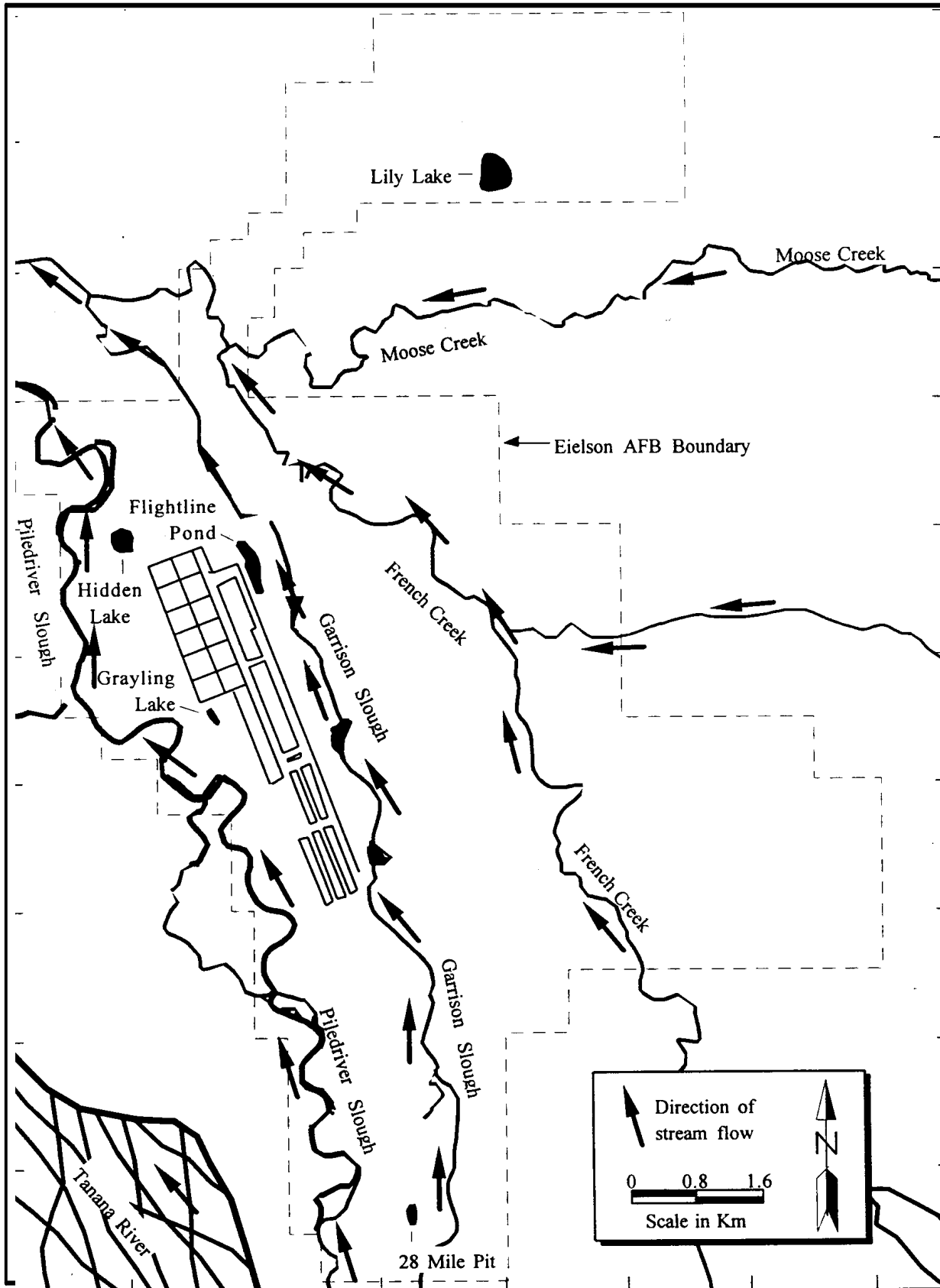
As a part of the Eielson Air Force Base (EAFB) Record of Decision developed by the U.S. Environmental Protection Agency's (EPA) Office of Environmental Clean-up, the United States Air Force (USAF) and the State of Alaska Department of Environmental Conservation (DEC), a Total Maximum Daily Load (TMDL), under Section 303(d) of the Federal Clean Water Act (CWA) has been developed to address nonpoint source loading of polychlorinated biphenyls (PCBs) into Garrison Slough.

Garrison Slough, a water body which passes directly through the developed portion of EAFB (Figure 1) is currently water quality-limited for PCBs (Aroclor 1260). Designated beneficial uses include freshwater water supply, water contact

recreation, and growth and propagation of fish, shellfish, and other aquatic life and wildlife. One "hot spot" of PCB contamination in sediments and fish tissue is in the lower portion of Garrison Slough behind the base civil engineering building. The highest concentration of PCBs found on site was 65 parts per million (ppm). Fish tissue concentration in this area exceed the Food and Drug Administration (FDA) level of two parts per million.

The final prescription for Garrison Slough will result in an eighty percent removal of PCBs from Garrison Slough. Additional controls measures (i.e base fishing restriction, grayling catch and release policy) will not only reduce the risk of human and aquatic animals<sup>1</sup> exposure to PCBs, but the designated beneficial uses will be restored. Through phased TMDL approach, a monitoring plan has been developed which will provide data to ensure that the controls will result in the attainment of water quality standards and protection of the beneficial uses. If monitoring shows water quality improvements are not being made within a reasonable period (eg. 6-8 years), the controls will be reevaluated. Additional dredging of sediments would take place if needed. Additional follow-up monitoring of fish tissue, instream water, and sediments will be conducted to ensure that water quality standards are being attained.

Figure 1





**PART 1. GENERAL WATERSHED/ SITE DESCRIPTION:**

EAFB is located in the Fairbanks, North Star Borough (FNSB) of central Alaska, approximately 40 km (24 mi.) southeast of Fairbanks and 16 km (10 mi.) southeast of the city of North Pole along Richardson Highway. The base covers an area of approximately 800 hectares (19,700 acres). Approximately 1500 hectares (3650 acres) are fully or partially developed on the east and south by Fort Wainwright, a U.S. Army installation, and on the west and north by private and public land. Other base facilities that are not contiguous with the main part of EAFB are the Blair Lakes Target Facility, about 72 km (45 mi.) southeast of Fairbanks, and the Birch Lake Recreation Area, about 48 km (30 mi.) south of the base. The base is isolated from major urban areas, with adjacent public and private land zoned for general use.

EAFB contains thirteen lakes totaling 1.3 sq km ( 0.5 sq.mi.), 54 ponds totaling 1 sq km (0.4 sq. mi.), and 10 designated wetlands totaling about 1 sq. km (0.4 sq. mi.). One lake and six ponds are natural; the remaining are old borrow pits or gravel pits.

Surface water bodies near EAFB include rivers, creeks, sloughs, lakes, ponds, and wetlands. Surface drainage at Eielson is generally north-northwest, parallel to the Tanana River. Several small sloughs and creeks pass through the base and discharge to the Tanana River. Moose Creek is the main receiving stream for small local drainages around the base. Both French Creek, along the eastern edge of the base, and Piledriver Slough, along the western edge, and Garrison Slough discharge to Moose Creek just above its confluence with the Tanana River. Garrison Slough passes directly through the developed portion of the base and is primarily an engineered drainage channel which drains to Moose Creek. Portions of Garrison Slough are enclosed in culverts.

**1a. CLIMATOLOGICAL CONDITIONS:**

The climate at EAFB is characterized by large diurnal and annual temperature variations and low precipitation. Average summer temperatures range between seven and sixteen degrees Celsius, while winter temperatures range from negative twenty-six to negative thirteen degrees Celsius. Average annual rainfall is 36 cm with 183 cm of snow.

**1b. AQUATIC BIOLOGY OF GARRISON SLOUGH:**

Seventeen species of fish are found on EAFB, including resident species such as northern pike, rainbow trout, and grayling. Of the seventeen species, northern pike and grayling are found in Garrison Slough. Anadromous species entering a few streams include chum salmon, coho salmon, and king salmon. Many water bodies

on EAFB have few or no fish due to natural winter kills and lack of a connection to areas containing fish, or to unsuitable habitat. Aquatic invertebrate, principally larvae and snails, are present in most streams and lakes on the base. These organisms are the primary food source for fish.

#### **1c. SOIL TYPE ON EAFB**

The base is located in the Tanana River Valley. Most of the base has been constructed on sand gravel fill. The topography in the developed portion of the base is generally flat and featureless with elevation averaging about 168 m (550 ft.) above sea level. Two-thirds of the base (mostly the undeveloped areas) is underlain by soils containing discontinuous permafrost. Half the potential agricultural soil is currently being used for recreation facilities, ammunition storage areas, Arctic Survival Training School, and other Air Force operations.

#### **1d. GROUNDWATER:**

The developed portion of the base is underlain by a shallow, unconfined aquifer comprising up to 91 m (300 ft) of alluvial sands and gravel with minor clay and silt overlying crystalline bedrock. Groundwater is the only source of potable water at the base and in the communities near the base. Potable water in the main base system is treated to remove iron and sulfate. Groundwater is the principle source for various other industrial, domestic, agricultural, and fire fighting purposes.

#### **1e. LAND USE:**

Current and future land use for water bodies on EAFB is recreation.

#### **1f. IMPAIRED WATERBODY LISTING / TMDL DEVELOPMENT:**

The Federal Clean Water Act Section 303(d)(1)(A) requires states to submit to the EPA, every two years, a list of waters which exceed water quality standards, after the implementation of technology-based or water quality-based controls. Garrison Slough is on DEC's 1994/1996 303(d) list. The pollutant parameter of concern is PCBs.

A total maximum daily load (TMDL) is a planning and management mechanism to restore water quality. The primary goal of a TMDL is to restore the designated beneficial uses of an impaired water body. This should be maintained through meeting and maintaining water quality standards. The TMDL is based on the relationship between pollutant sources and instream water quality conditions. The TMDL establishes the allowable loading for a water body and thereby provides a basis for water quality-based controls.

A phased approach to TMDL development is appropriate when existing data are not adequate to determine needed pollutant load reductions from pollutant sources being addressed, or to determine the controls necessary to address impairments. In a phased TMDL, controls are instituted, and monitored to determine whether the controls are making adequate progress toward the attainment of water quality standards. If monitoring shows water quality improvements are not being made within a reasonable time frame, the controls will be reevaluated and further mechanical dredging of sediments will take place if necessary. Additional follow-up monitoring of fish tissue, instream water, and sediments will be conducted to ensure that water quality standards are being attained.

## Part 2. APPLICABLE STANDARDS:

Within the State of Alaska, water quality standards are published pursuant to Title 46 of the Alaska Statutes (AS). Regulations dealing with water quality (46.03.020 & 46.03.080), are found in Title 18, Chapter 70 of the Alaska Administrative Code (AAC). Through the adoption of water quality standards, Alaska has defined the beneficial uses to be protected in each of its drainage basins and the criteria necessary to protect these uses. See Table 2 for the beneficial uses and criteria applicable to Garrison Slough.

Table 2

<b><u>Uses Protected by Alaska's Water Quality Standards</u></b> <b>18 AAC Freshwater Uses</b>		
<b>70.020 (1) (A) Water Supply</b>	0 0 0 0	<b>Drinking, Culinary and Food Processing Agriculture, including livestock and irrigation Aquaculture Industrial</b>
<b>70.020 (1)(B) Water Recreation</b>	0 0	<b>Contact Recreation Secondary Recreation</b>
<b>70.020 (1)(C) Growth and Propagation of fish, shellfish, other aquatic life, and wildlife</b>		

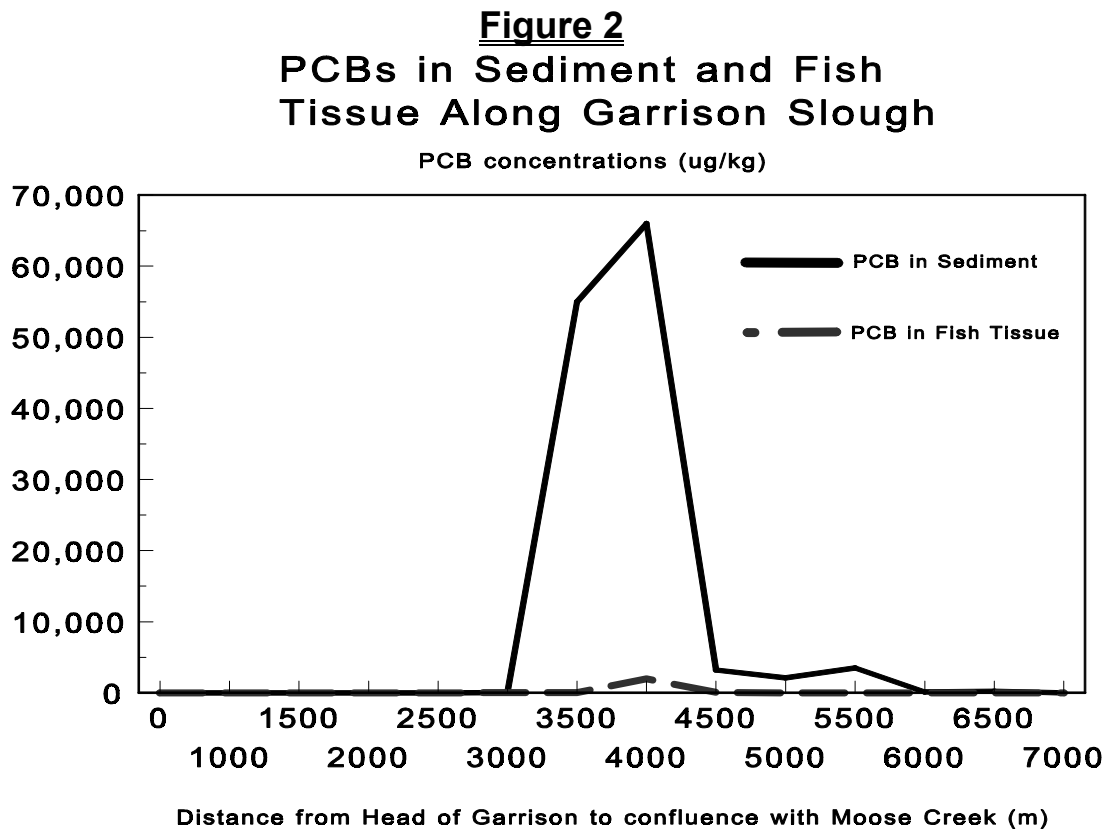
### 2a. BENEFICIAL USES AFFECTED:

Based on the Comprehensive Environmental Response, Compensation Liability Act (CERCLA) risk assessment, neither the sediments nor surface water pose an unacceptable direct risk to humans or ecological receptors. However, aquatic life bioaccumulate PCBs from contaminated sediments. The consumption of this aquatic life (I.e fish, shellfish) poses an elevated health risk to humans. Also, the aquatic life's



exposure to PCBs impairs fisheries the beneficial use in itself, as defined by the state (AAC 70.020 (1)(B), (1)(C)).

A strong spatial relationship appears between PCB concentrations in sediment and fish. The highest concentrations in sediments were measured in Garrison Slough near Arctic Avenue (lower Garrison Slough); similarly the highest concentrations in fish tissue were measured in fish caught in lower Garrison Slough (Figure 2).



Based on data presented in the Baseline Risk Assessment for Garrison Slough, it appears that a complete exposure pathway exists from the sediment to fish in lower Garrison Slough, and that the high concentrations in fish tissues are a direct result of exposure to the contaminated sediments. The uptake of PCBs by fish may occur through incidental ingestion of contaminated sediment while feeding, and ingestion of contaminated water and prey. Fish that remain in lower Garrison Slough are likely to continue to bioaccumulate PCBs without the controls of the TMDL.

## **2b. WATER QUALITY STANDARD FOR PCBs IN GARRISON SLOUGH:**

Once a State designates uses, it establishes water quality criteria to protect those uses. Together, the criteria and designated uses constitute the State's water quality standards.

Alaska water quality standards presently being exceeded are the narrative criteria for toxic and other deleterious organic and inorganic substances in sediment, and residue in fish tissue which impairs water recreation and growth and the propagation of fish, shellfish, other aquatic life and wildlife. See Table 3 and Table 4 for Alaska Water Quality Standards for Toxic and Other Deleterious Organic and Inorganic Substances and Residues

Table 3: Alaska Water Quality Standards for Toxics

<b>Toxic and Other Deleterious Organic and Inorganic Substances</b>	
<b>(A) Water Supply (i) drinking, culinary and food processing</b>	<b>Substances may not exceed Alaska Drinking Water Standards (18 AAC 80) or, where those standards do not exist, EPA Quality Criteria for water.</b>
<b>(A) Water Supply (ii) agriculture, including irrigation and stock watering</b>	<b>Same as (1)(A)(i) where contact with a product destined for human consumption is present. Same as (1)(C) or Federal Water Pollution Control Administration, Water Quality Criteria (WQC/FWPCA), as applicable to substances for stock waters, concentration for irrigation water may not exceed WQC/FWPCA or WQC 1972</b>
<b>(A) Water Supply (iii) aquaculture</b>	<b>Same as (1)(C)</b>
<b>(A) Water Supply (iv) Industrial</b>	<b>(iv) Substances that pose hazards to worker contact may not be present.</b>
<b>(B) Water Recreation (i) contact recreation</b>	<b>Same as (A)(i)</b>
<b>(B) Water Recreation (ii) secondary recreation</b>	<b>(ii) Substances that pose hazards to incidental human contact may not be present</b>
<b>(C) Growth and Propagation of Fish, Shellfish, other Aquatic Life, and Wildlife</b>	<b>Individual substances may not exceed criteria in EPA Quality Criteria for Water, or if those criteria do not exist, may not exceed the Primary Maximum Contaminant Levels of the Alaska Drinking Water Standards. If those criteria are absent, or if the department find that the criteria are not appropriate for sensitive resident Alaska species, the department will, in its discretion, establish in regulation chronic and acute criteria to protect sensitive and biologically important life stages of resident Alaskan species, using methods approved by EPA or alternate methods approved by the department. There may be no concentrations of toxic substances in water or in shoreline or bottom sediments, that, singly or in combination, cause, or reasonably can be expected to cause, toxic effects on aquatic life, except as authorized by this chapter. Substances may not be present in concentrations that individually or in combination impart undesirable odor or taste to fish or other aquatic organisms, as determined by either bioassay or organoleptic tests.</b>

Table 4: Alaska Water Quality Standards for Residues

<b>Residues</b> <b>Floating Scum, Debris, Sludge, Deposits, Foam, Scum, or Other Residues</b>	
<b>(A) Water Supply (I) drinking, culinary and food processing</b>	<b>May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substance, cause a film, sheen, or discoloration on the surface of the water or adjoining shoreline, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines</b>
<b>(A) Water Supply (iv) Industrial</b>	<b>May not, alone or in combination with other substances or waste, make the water unfit or unsafe for the use.</b>
<b>(B) Water Recreation (I) contact recreation</b>	<b>Same as (A)(I)</b>
<b>(B) Water Recreation (II) secondary recreation</b>	<b>Same as (A)(I)</b>
<b>(C) Growth and Propagation of Fish, Shellfish, other Aquatic Life, and Wildlife</b>	<b>May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substance, cause a film, sheen, or discoloration on the surface of the water or adjoining shoreline, or cause leaching of toxic or deleterious substances, or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines.</b>

**National Toxics Rule:**

The National Toxics Rule (40 CFR 131.36(12)(I)(ii)(iii)) promulgated in December 1992, inventoried both human health and aquatic life criteria for 126 toxic pollutants and established numeric criteria for priority toxic pollutants. It required that the human health criteria be applied at a risk level of  $10^{-5}$  in Alaska.

**2c. PARAMETER OF CONCERN:**

Garrison Slough has been placed on the State of Alaska 1994/1996 303(d) list for exceeding the water quality standard for toxics found in sediments and the water quality standard for residues found in fish tissue.

Studies have shown that PCBs absorption to sediments is the major nondestructive process affecting PCBs after introduction to the aquatic environment. The combination of the low water solubility and the high octanol-water partition coefficient indicates that PCBs will have a high affinity for suspended solids, especially those in organic carbon. When contamination becomes sufficiently high, sediments may serve as a reservoir for re-

solution of polychlorinated biphenyls (Veith and Comstock 1975). This fact has important ramifications for areas where PCBs are spilled; even after the initial degradation in water quality, release of PCBs from sediments can cause long term pollution.

### PART 3. SOURCE OF CONTAMINATION:

The PCBs found are believed to have originated from old transformers stored in the EAFB civil engineering building. The principle site of PCB contamination near Garrison Slough is via soils in a trench located adjacent to Garrison Slough. The soils from the trench are then transported into Garrison Slough through surface water runoff.

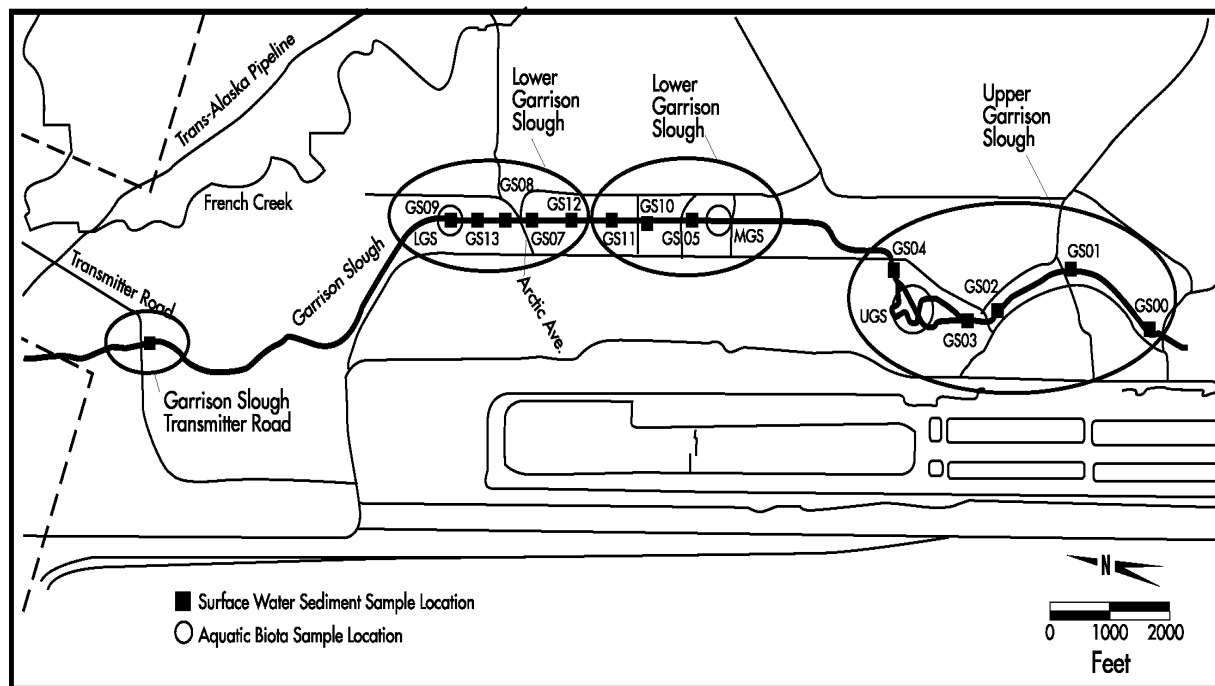
### PART 4. AVAILABLE MONITORING DATA:

All data used in determining that Garrison Slough is a water quality limited water body are contained in the Sitewide Baseline Risk Assessment Report for Eielson AFB were collected by Pacific Northwest Laboratories (PNL) from 1992 to 1994. This includes surface water, sediment, groundwater, and fish tissue data. (Site Map 2)

#### 4a. SEDIMENT AND SURFACE WATER:

Sediment and PCB data were collected in 1993 and 1994. The 1994 data were used where 1) a location had not been sampled in 1993; 2) a specific analyte was not sampled in 1993, and 3) the concentrations detected at a particular site were higher in 1994.

**Figure 3**



Surface water samples were also collected in 1993 and 1994, typically from the same location each year. Metals data were only collected in 1993. Samples were collected from the same locations as the sediment samples. Both total and dissolved analyses were performed; however, only total values were used in the risk assessments.

#### **4b. VOLATILE ORGANIC COMPOUNDS (VOCs) AND PESTICIDE SAMPLES:**

VOCs were collected in surface water in 1993 and 1994. The 1993 data were preferred because they had lower contract required quantitation limits (CRQLs). The 1994 data were only used where an analyte was detected at a higher concentration, as was true with trichloroethylene at two locations.

Pesticides and PCBs were also sampled in 1993 and 1994. Similar to the sediment data, the 1993 samples were preferred because of lower CRQLs.

#### **4c. FISH TISSUE SAMPLES:**

Fish tissue data were collected in 1993 and 1994 (Table 5). Only a limited sampling of data was collected in 1993 as part of the sitewide biological risk assessment, because detecting contaminants in fish tissue was not expected. Six samples were acquired and analyzed for poly-aromatic hydrocarbons (PAHs), pesticides, and PCBs.

Table 5

<b>1993 Fish Tissue Samples</b>			
Sample Location	Detections		
	PAHs	Pesticides	PCBs
Lower French Creek	X	X	X
Upper Garrison Slough	X	X	X
Middle Garrison Slough	X	X	X
Lower Garrison Slough	X	X	X
Flightline Pond	X		

The calculated potential risk to human health was great enough that an extensive sampling event was conducted in 1994. Fifty-six samples, including duplicates and splits, were acquired at 14 sites. Arctic grayling were collected at all sites except Hidden Lake and 28 Mile Pit (Upper Garrison Slough).

The purpose of the 1994 effort was to determine the extent of fish contamination onsite, to evaluate whether the contaminated fish were symptomatic of a sub-regional

contamination problem, to determine background contamination levels for fish from undeveloped watersheds, and to determine if the contamination was in edible fish tissue.

Results from the 1994 data indicated that fish are contaminated with PCBs along Garrison Slough, and all fish have some pesticide contamination, primarily DDT and its metabolites. No PAHs were detected in any of the 1994 samples.

## **Part 5. TMDL EVALUATION**

### **5a. Selection of Loading Capacity**

The loading capacity of a stream is determined using the water quality criteria value and a design flow for the receiving water. Typical loads are expressed as chemical mass per time such as pounds per day. The narrative water quality criteria for both "**Toxics and Residues**", does not provide the numeric values needed to easily calculate a load.

40 CFR 130.2 (j) states that TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures that relate to a State's water quality standards<sup>4</sup>. Due to the lack of sediment criteria for PCBs and the lack of appropriate environmental condition to calculate a loading capacity, this TMDL will be expressed in terms of Load Reduction (LR).<sup>4</sup> This LR focuses on sediment PCB concentrations, and is based upon the assumptions that reductions in sediment PCB concentrations will result in a linearly-related reduction in fish tissue PCB concentrations.

We believe that through the implementation of various control measures that reduce sediment PCB concentrations (e.g dredging of the contaminated sediments from the slough) as well as the installation of various institutional controls (i.e fishing restrictions), the designated beneficial uses for Garrison Slough will be restored.

Data gathered from the Eielson AFB Sitewide Investigation Sampling Results indicated that, while PCBs are a problem in the sediment, they were not detected in the water column. Thus, calculation of an allowable load<sup>4</sup> in the traditional sense serves little value. However, because contaminated sediments already exist in the slough, no additional loading of PCBs is allowable.

The ultimate goal of this phased TMDL is to achieve the  $10^{-5}$  risk level to protect both human health and aquatic life in and around Garrison Slough. This goal will eventually be attained by removing the PCB contaminated sediments from Garrison Slough, installing various institutional control to alleviate any potential risk. Follow-up monitoring is one of the critical components of this TMDL, to ensure that adequate progress is made toward attaining the TMDL goal. The indicator that will be used to determine progress in reducing PCBs levels will be the concentrations of PCBs in the adipose tissue of juvenile graylings.

If monitoring shows water quality improvements are not being made within a reasonable time frame (i.e 5-6 years), the controls will be reevaluated and further mechanical dredging of sediments will take place if necessary.

**5b. Current Instream PCB Load:**

In determining the current PCB instream sediment loading/concentration in Garrison Slough, sediment sample results from Garrison Slough were evaluated (Figure 4). PCBs were measured from just upstream of Arctic Avenue to Transmitter Road.

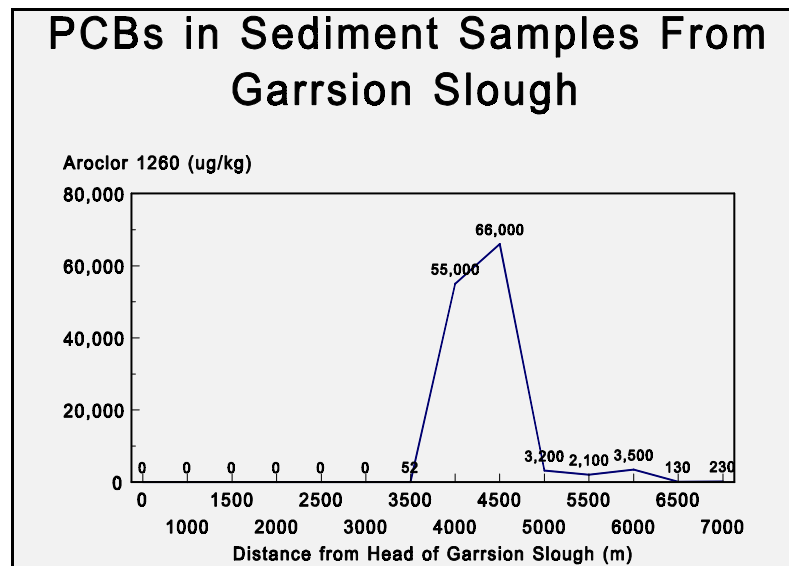


figure 4

The highest PCB concentrations found in Garrison Slough sediments were upstream of Arctic Avenue, with a maximum concentration of 66 mg/kg dry weight PCBs (Aroclor 1260) found in a sample collected 15 m (50ft) downstream of Station GS12. A PCB concentration of 55 milligrams per kilograms was also found in sediment at sampling station GS12. The PCB concentrations dropped by an order of magnitude approximately 700 m (2300 ft) downstream (Station GS09). Only one upstream contaminated site was found in a sample 15m (50ft) upstream of Station GS12, with a PCB concentration of 52 mg/kg dry weight. A sample collected 15 m (50 ft) upstream from this point has no detectable PCBs.

**5c. PRESCRIPTIONS:**

In developing prescriptions for Garrison Slough, the ADEC, USAF, and EPA evaluated a number of alternatives. For sediments and fish, the clean-up objectives are three fold. The first objective is to reduce the PCB levels in sediments so that concentrations in fish tissue will be reduced to acceptable risk levels. The second objective is to prevent people from eating PCB contaminated fish until PCB tissue concentrations are lowered to

acceptable risk levels. The third objective is to restore and protect the designated beneficial uses for Garrison Slough.

Eighty percent of the contamination will be addressed by the preferred clean-up alternative thru CERCLA. Assuming a linear relationship for the bioaccumulation factor, the corresponding concentration in fish tissue should also be reduced by 80% for any fish that comes in contact with sediments.

To help in differentiating between fish/aquatic organisms that are presently in the slough and have potentially been exposed to PCBs versus new fish that could migrate to the slough and become contaminated, the slough will be electro-shocked before remediation efforts start. In addition to electro-shocking, an engineering control (i.e weir) will be installed downstream before the confluence with Moose Creek to prevent fish from migrating upstream while active remediation is underway.

In determining what prescriptions would be feasible for Garrison Slough, five alternatives were evaluated. (Table 6.)

Table 6. Alternatives Evaluated

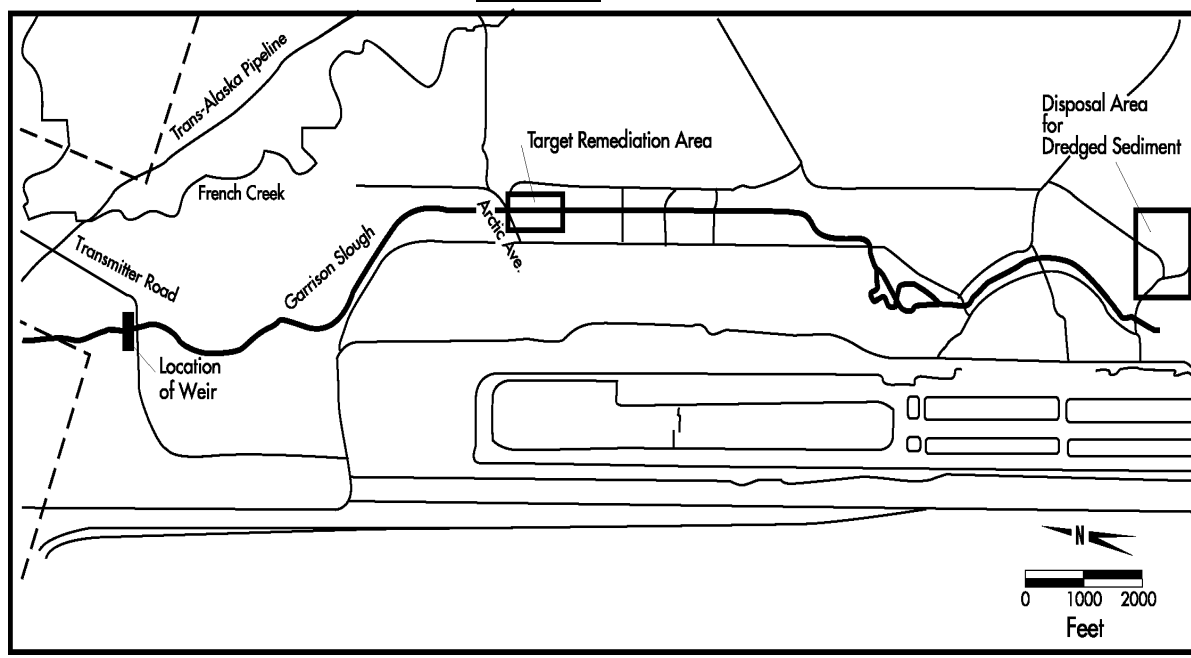
<b><i>Alternative Evaluated</i></b>	<b><i>Narrative Description of Alternatives</i></b>
<b><u>Alternative 1:</u></b> <b><u>No Remedial or</u></b> <b><u>Removal Action</u></b> <b><u>(Monitoring Only)</u></b>	No action would be taken to reduce contaminate concentrations in either fish or sediment. This alternative includes natural degradation and dispersion to reduce contaminated concentrations in sediment and fish.  The cost of 30 years of fish and sediment monitoring is \$98,384.
<b><u>Alternative 2: Limited</u></b> <b><u>Action and Monitoring</u></b>	Institutional controls would be implemented to restrict the amount of fish caught for food and engineering controls to restrict the migration of fish into the contaminated portion of Garrison Slough. The action would then limit human exposure to PCBs by interrupting the ingestion pathway. The controls include the following:  1. Fish Advisories Restrictions 2. Physical Fish Controls (e.g. Dam)  The estimated cost of \$139,948 includes 30 years of fish and sediment monitoring.
<b><u>Alternative 3:</u></b> <b><u>In Situ Capping</u></b>	PCB-contaminated sediments in the 300-m stretch upstream of Arctic Avenue would be left in place, but covered with a multi layer cap to isolate it from the ecosystem. Isolating the contaminated sediments would, overtime, lead to a reduction in PCB concentrations in the fish population. Institutional controls would also be implemented as those identified above in Alternative 2. The estimated cost of \$290,000 includes 8 years of fish tissue monitoring and 3 years of sediment monitoring.
<b><u>Alternative 4: Dredge</u></b> <b><u>and Disposal</u></b>	This option would require mechanical dredging of PCB contaminated sediments in the 300-m stretch of Garrison Slough upstream of Arctic Avenue followed by on-site disposal of the dredged material. This dredging would produce 600 m <sup>3</sup> of contaminated sediment. On-site disposal of PCB contaminated sediments would require movement of the dredged material to an inactive base landfill for concentrations less than 50 part per billion. Institutional controls would also be implemented as those identified above in Alternative 2. The estimated cost of \$190,979 includes 8 years of fish tissue monitoring and 3 years of sediment monitoring.
<b><u>Alternative 5:</u></b> <b><u>Dredge and Treat</u></b>	The Dredge and Treat alternative is similar to dredge and dispose, except that the dredged material would be treated to permanently destroy the PCBs. Land farming



**Alternative Evaluated****Narrative Description of Alternatives****Alternative 1:**  
**No Remedial or**  
**Removal Action**  
**(Monitoring Only)**

No action would be taken to reduce contaminant concentrations in either fish or sediment. This alternative includes natural degradation and dispersion to reduce contaminated concentrations in sediment and fish.

The cost of 30 years of fish and sediment monitoring is \$98,384. would degrade the PCBs over several months to years. A biological agent, such as white rot fungus, would be mixed with cellulose/lignin base food source and nutrients to degrade PCBs. Institutional controls would also be implemented as those identified above in Alternative 2. The estimated cost of \$216,821 includes 8 years of fish tissue monitoring and 3 years of sediment monitoring.

**Figure 5****Final Selected Prescriptions:**

The selected prescriptions as described in the ROD for the site, are a combination of Alternative 2 and Alternative 4. The following activities represent work that will take place on Garrison Slough.

- 0 Fishing advisories posted along the slough.
- 0 Installation of a weir near the downstream edge of EAFB to prevent fish movement during dredging (Site Map 3).
- 0 Mechanical dredging of PCB contaminated sediments, which is expected to result in removal of 80% of PCB volume.
- 0 On-site disposal of PCB contaminated sediments at inactive base landfill

- O Long-term monitoring of surface water, sediment, and fish.

**PART 6. IMPLEMENTATION PLAN:**

**PART 7. MONITORING PROGRAM:**

Sediment, water, and aquatic organisms (fish included) will be monitored thirty years to ensure targeted risk reduction levels are being attained. If persistent levels of PCBs continue, the ROD and TMDL can be modified to achieve additional improvements..

**PART 8. PUBLIC PARTICIPATION PROCESS**

